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UNESCO/MAB Regional Seminar: Methods of Biological Inventory and Cartography for Ecosystem Management (BICEM) October 9–14, 1989

UNESCO/MAB Regional Seminar on Methods of Biological Inventory and Cartography for Ecosystem Management (BICEM) was held at Tokyo University of Agriculture in Tokyo (October 9 and 10) and at Tokyo University of Agriculture Fuji Farm in Fujinomiya, Shizuoka Prefecture, at the western foot of Mt. Fuji (October 11–13). It was organized by Japanese National Committee for MAB and Tokyo University of Agriculture with cooperation of UNESCO and Japanese National Commission for UNESCO as a seminar that fundamentally follows activities of the past five meetings of MICE (Man's Impact on the Coastal and Estuarine Ecosystems) held from 1984 to 1988 in Japan, Indonesia, Thailand or China, supported by UNESCO and the Japanese Government. The total number of participants in the BICEM Seminar was 48, including three from Indonesia, one from Malaysia, seven from Thailand, one from the Philippines, one from China, one from Korea, one from France (UNESCO Headquarter), one from Germany, two from USSR, and one from USA.

On October 9, at the Opening Session addresses were released by five distinguished speakers: Prof. T. Nakamura, Chairman of Organizing Committee for BICEM, Prof. Y. Takai, Chairman of Japanese National Committee for MAB, Prof. A. Maekawa for Dean of Tokyo University of Agriculture, Mr. M. Nishimura Deputy Secretary General of Japanese National Commission for UNESCO, and Dr. Kuswata Kartawinata, UNESCO/ROSTSEA. After the Opening Session the scientific session was started with the plenary lecture by Dr. Han Qunli, UNESCO Headquarter, on "Use of GIS in conservation planning and resource management," followed by the plenary lectures by Dr. Gomez Dallmeier, Smithsonian Institution of Washington, on "Biological diversity conservation and research in developing countries: Smithsonian and Unesco Man and Biosphere Joint Biological Diversity Program," by Dr. Kuswara Kartawinata, UNESCO/ROSTSEA (Indonesia), on "Progress on vegetation and ecological studies in Malesia, with special reference to Indonesia," by Dr. Samaran Panichapong, IBSRAM (Thailand), on "Application of remote sensing information for land use mapping—Thailand experience," and by Dr. Y. Kato, Shizuoka University, on "Soil and volcanic landscapes at the foot area of Mt. Fuji."

In the evening of October 9 the welcome reception was hosted by Prof. T. Matsuda, Dean of Tokyo University of Agriculture, at the Green Academy Hall, Tokyo University of Agriculture. All the participants enjoyed hospitalities and dishes.

On October 10, scientific papers were presented mainly on research and mapping methodology for soil and vegetation by the following persons: Dr. Pisoot Vijarnsorn (Thailand), Dr. Sarwono Hardjowigeno (Indonesia), Dr. Zahari Abu Bakar (Malaysia), Dr. Yim Yang-Jai (Korea), Dr. Takao Kikuchi (Japan), Dr. Chawalit Niyomdham (Thailand), Dr. Rochadi Abudulhadi (Indonesia), Dr. Irina Malkina (USSR), Dr. Keitaro Hara (Japan), Dr. Kharin Nikolai (USSR), Dr. Bubpha Topark-ngarm (Thailand), Dr. Charles W. Heckman (Germany), and Dr. He Miao-guang (China). Fruitful discussions were made for each of these presentations.

On October 11–14, field study and workshop were conducted at Tokyo University of Agriculture Fuji Farm. Among those the highlight was a practice of balloon photography, starting with charging helium gas in a balloon to take aerial photographs of vegetation. Each participant in turn enjoyed releasing the shutter by remote-control panel. The photographs were used in the workshop the next day. Soil profiles were observed at several sites in and near the farm under the guidance of Rrof. Y. Kato and other Japanese scientists. Vegetations at the middle elevation of Mt. Fuji were also studied together with observations on soils under the guidance of Dr. K. Hara, Dr. Y. Sasaki, Dr. K. Suzuki, Dr. T. Nakamura, Dr. Y. Kato, Dr. M. Okazaki and Dr. T. Takagi.

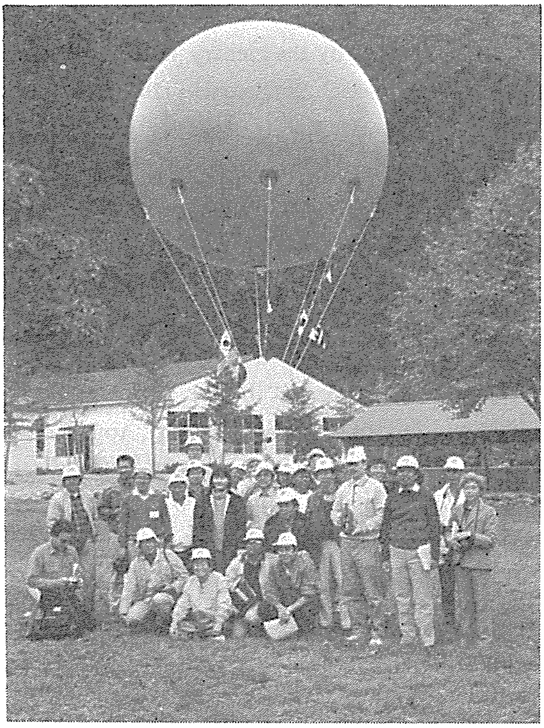

Fig. 1. A balloon for aerial photography and the participants of the workshop.

Fig. 2. An aerial photograph by use of balloon.

Weather was not favorable on October 11 and 12, but on October 13 and 14 the participants could enjoy the beautiful scenery of Mt. Fuji. After discussions for summarizing the seminar, a farewell barbecue party was given by courtesy of the organizing committee and Tokyo University of Agriculture. All the participants enjoyed the party with singing songs of their own respective country and extending warm friendship.

On October 14, the participants returned to Tokyo to take lunch at the Green Academy, Tokyo University of Agriculture. After lunch

Prof. Y. Takai and Prof. T. Nakamura stated the closing of the seminar, thanking for cooperation of the participants.

Yusho Aruga,
Tokyo University of Fisheries

Comparative Studies on Coastal Wetland Soil Ecosystems in Peninsular Thailand and Malaysia

Kazutake Kyuma and Yasuo Takai

The coastal swamps are now being reclaimed very rapidly in many southeast Asian countries either for agriculture or for aquaculture. There are, however, problems arising from soil conditions of the swamp land, one being poor physical and chemical properties of tropical peat under the swamp forest and the other being acidification of pyritic sediments accumulated under mangrove forest. Because of such difficulties coastal swamp reclamation sometimes ends up with a failure in spite of a large investment of capital and labor. In view of the uniqueness of the coastal swamps in southeast Asia, such a useless wastage is really to be regretted. The notion that one of the causes of such a failure is the scarcity of our knowledge on the coastal soil ecosystems is the fundamental motivation of the present study.

The research has been carried out in cooperation with Thai and Malaysian researchers in the framework of MAB regional cooperation. The area around Narathiwat in Peninsular Thailand and that around Pontian, Johore, Malaysia were chosen as the research site in 1987 and 1988, respectively, and since then cooperative researches have been conducted by the members listed at the end of this report.

Research Methodology and Results in 1988–1989

a) Balloon photography for vegetation mapping

In addition to the areas studied in previous years, a few more areas both in Narathiwat and Johore were photographed by the balloon technique for vegetation mapping. The results were quite satisfactory and a high resolution vegetation map would be obtained after an image analysis. In addition to the vegetation mapping a preliminary trial to take micrometeorological data above swamp forests and reclaimed crop lands was made with an intention to expand the use of the balloon technique. This gave us a promising result.

b) Studies on soil and water in natural and reclaimed peat

Mineral and organic constituents of peat samples from both Narathiwat and Johore were analyzed. Major findings are listed below:

(i) Total phosphate, potassium, calcium and magnesium contents in the surface peat soils were roughly one order lower than those in mineral soils on the weight basis, suggesting even lower contents on the volume basis.

(ii) Normally the level of micronutrients, Fe, Mn, Zn and Cu, was also very low. Of those Mn and Zn were critically low in their total content, while Fe and Cu were present mostly in strongly complexed or non-extractable forms, suggesting a very low availability.

(iii) Not only mineral nutrients but also nitrogen content was low in woody peat in comparison with the temperate peat from Hokkaido, Japan.

(iv) Polysaccharide, tannin, hemicellulose and cellulose contents decreased after reclamation, rapidly for the first five years and more slowly

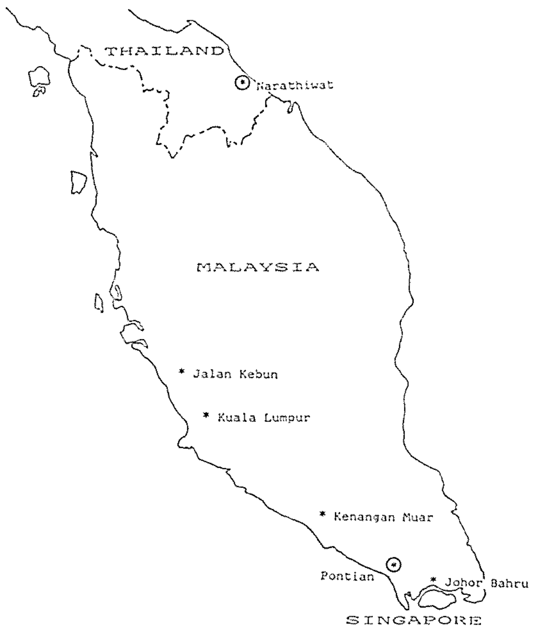

Fig. 1. Location map of the study sites: Main sites are encircled.

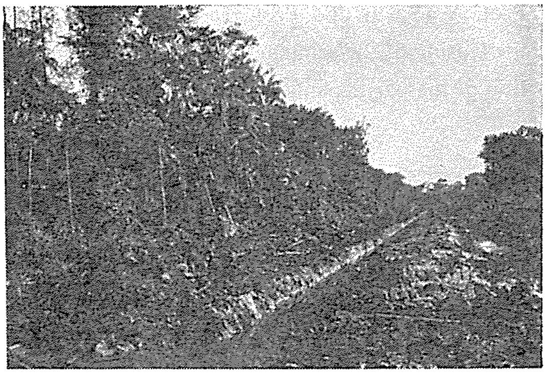

Plate 1. Reclamation front in swamp forest area.

thereafter. Wax and resins tend to increase as *Melaleuca* intrudes into burned peat land. Lignin decreased very slowly, while humified materials increased quite rapidly after reclamation. The latter two were much higher in tropical woody peat as compared with the temperate peat.

(v) Results of IR spectrography, functional group analysis, and proton NMR generally coincided with the above changes in organic composition.

(vi) The following seven phenolic compounds were detected in a hot ethyl acetate extract; protocatechuic acid, *p*-hydroxy benzoic acid, vanillic acid, syringic acid, vanillin, *p*-coumaric acid, and ferulic acid. They tended to decrease very rapidly after reclamation of peat.

c) Forest ecological studies

A 50 m × 10 m forest plot was laid in 1988 along Parit 5/39 of the Ayer Baloi reclamation area of Pontian, Johore, to obtain the baseline information of swamp forest. As the area has been drained since 9–11 years ago, the plot may not represent the authentic swamp forest, but it still has an appearance of natural swamp forest. All the trees with more than 4 cm of diameter at breast height (DBH) were mapped and measured for their height (H) and DBH and their species name was recorded in consultation with a plant taxonomist.

In the 500 m^2 plot, 104 alive trees were numbered, giving an estimate of tree density of 2080 trees/ha. The mean height was 9.5 m with the tallest being 41.6 m, and the mean DBH was 9.6 cm with the largest being 65.9 cm. Three tree layers were identified, emergent layer taller than 30 m, middle layer taller than 10 m and the understory below 10 m.

Relationship between tree height and DBH was hyperbolic and the following reciprocal equation of Ogawa *et al.* (1965) could be fitted:

$$1/H = 0.8488/DBH + 0.0163.$$

An expected upper limit of tree height is 61.3 m.

Above-ground biomass may be estimated using the observed largest value of tree height and the sum of basal areas of living trees, according to the following equation proposed by Yamakura *et al.* (1986):

$$Yt/Hmax = 0.2237 \times BA + 0.1628,$$

where BA is the sum of basal areas of trees greater than or equal to DBH of 4.5 cm. In this study plot, BA was 30.5 m^2 and the observed highest value of tree height was 41.6 m, thus giving an estimate of 291 tons C/ha for the above-ground biomass. This estimated biomass value is reasonable staying within the range from 142 to 664 tons C/ha proposed by Whitmore for the lowland evergreen rain forests of southeast Asia.

Tree litter was collected for a year round to estimate the nutrient cycling under the swamp forest. They were separated into leaves, twigs, reproductive organs and others, total weight of which amounted to 6.355 tons/ha/year.

Soil respiration was measured twice a month also for a year round to estimate the rate of decomposition of peat both under the forest and in reclaimed land. Preliminary analyses revealed that about 21 tons C/ha/year were evolved from the reclaimed bare field as compared to 11.5 tons C/ha/year from the forest. The difference in the rate of peat decomposition is even larger, amounting to as much as 3 times, for the reclaimed bare fields, if the root respiration under the forest, which is said to amount to 40% of the total soil respiration, is taken into consideration. The enhanced rate of soil respiration is directly related to a high soil temperature in the reclaimed field, where the daily maximum soil temperature is higher than under the forest by 13–25 degrees. After a more careful analysis of the data we will calculate the rate of subsidence of peat due to the decomposition of peat material, and the annual rate of nutrient release from the peat decomposition.

d) Studies on soil organisms

Preliminary studies on soil microflora and fauna were conducted. Soil samples were taken both under the forest and in the reclaimed field.

(i) Under the natural swamp forest fungi of *Trichoderma* spp. were predominant, while in the reclaimed and cultivated plots fungi of *Aspergillus* and *Penicillium* spp. replaced *Trichoderma* and at the same time bacteria of *Pseudomonas* and *Bacillus* spp. became more prominent.

(ii) Total microarthropod population was abundant under natural forest and in a coconut plantation. It was least in the newly reclaimed (slash and burn) field. Mesofauna was most abundant also under natural forest, whereas its biomass was largest in the coconut plantation. Number of taxonomic groups of macrofauna was 5, 4, 10 and 14 in the newly reclaimed field, pineapple field, coconut plantation and natural forest, respectively.

(iii) Felling and burning seemed to decrease the diversity and abundance of soil animals. Deforestation may cause changes in microenvironment in the surface soil, e.g. soil temperature, physical properties, etc. It is difficult to establish simple relationships between abundance of soil animals and mean soil water content and/or soil acidity.

(iv) Generally abundance and biomass of soil

Plate 2. Felling and burning of swamp forest.

Plate 3. Research team at work: Describing and sampling peat.

animals in the tropical peat swamp ecosystem were lower compared with those in the cool temperate and temperate forest ecosystems. Suppression by submergence and flooding may explain the lower abundance of soil animals under the swamp forest. Thus the role played by soil animals in the process of decomposition of peat may not be very significant.

e) Studies on plant nutrition

Nutritional disorders appear to be a widespread problem on peat lands, but no detailed studies have so far been conducted particularly with tropical peats. Preliminary results of studies on the plant nutritional aspects are given below.

(i) Leaf samples collected from crops and weeds grown in the Pontian Peat Station were analyzed for nutritional characteristics. Deficiencies of N, P, K, Mg, S, Fe, Mn, Cu, Zn and B were suspected from their growth symptoms and nutrient contents. Particularly deficiencies of P, S, Fe, Mn and Zn seemed to be the principal nutritional problems.

(ii) Effects of phenolic acids, which occur in peat soils as monomers such as *p*-hydroxybenzoix acid, vanillic acid, syringic acid, *p*-coumaric acid and ferulic acid, on crop plants were studied by solution culture. All of them exhibited toxic effects on plant growth in the following order: ferulic acid > *p*-coumaric acid > vanillic acid ≒ syringic acid > *p*-hydroxybenzoic acid.

(iii) Absorption of K, P, Cu and Zn was inhibited with an increase of phenolic acid concentration in the nutrient solution. In case of Cu and Zn, complex formation with phenolic acids appeared to be a cause of inhibition in addition to the inhibition of metabolic absorption.

(iv) Tolerance of crop plants to phenolic acids was in the order of rice > wheat > maize ≒ soybean > tomato.

(v) The effect of *p*-hydroxybenzoic acid as the causal material of rice sterility could not be confirmed, though it reduced the weight of rice shoots and ears at a concentration higher than 0.25 mM. Likewise other phenolic acids were not considered either to induce rice sterility by themselves.

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Nature and Conservation of the Bhutan Himalaya

Masahiko Ohsawa

Bhutan is a country located in the East Himalaya above Assam of India, and is one of the most unknown part of the Himalaya at least in an ecological sense. The total land area is about 46,500 square kilometers having the population of about 1.3 million, which is equivalent to the population density of c. 29 persons per square km, and it is one fourth to third of that of Nepal. Relatively low population density is probably one of the crucial factors which kept the country's nature so nice among the Himalayan region. Because of this rich nature, we are interested in studying of the Bhutanese nature. The information about the intact ecosystem of the Himalaya is very important to elucidate the origin and diversification of the Himalayan ecosystem. It is also helpful to conserve or to restore the degraded ecosystem in the Himalaya. We intended to get the integrated knowledge about the diversified nature of Bhutan, therefore our team was composed of several plant ecologists along with a climatologist, a geomorphologist and a pedologist.

Of course Bhutanese Government has realized the importance of nature conservation, and the authorities are developing various measures for nature conservation, such as the establishment of wild life sanctuaries, rules for tree cutting, and social forestry. We hope that our result can also contribute to nature conservation in Bhutan.

History of our project

My first visit to Bhutan was in 1984 together with Prof. M. Numata for discussing about future cooperation of nature study in Bhutan with the Bhutanese officials. According to the agreement, we dispatched the first scientific team to carry out field survey under the financial support by Monbusho, a Grant-in-Aid for Overseas Research, through MAB-related project in 1985. The study area ranged from tropical life zone, 150 m at Manas to nival zone, 5,700 m near Tibetan border to get overview of the life zones. The results were published as a report entitled 'Life zone ecology of the Bhutan Himalaya' in 1987. After the publication, I visited Bhutan the third time to submit the report to the Bhutan Government and discussed about future plan in 1987. The report was welcomed by some people of Bhutan, because there are so far few such scientific books on Bhutanese nature.

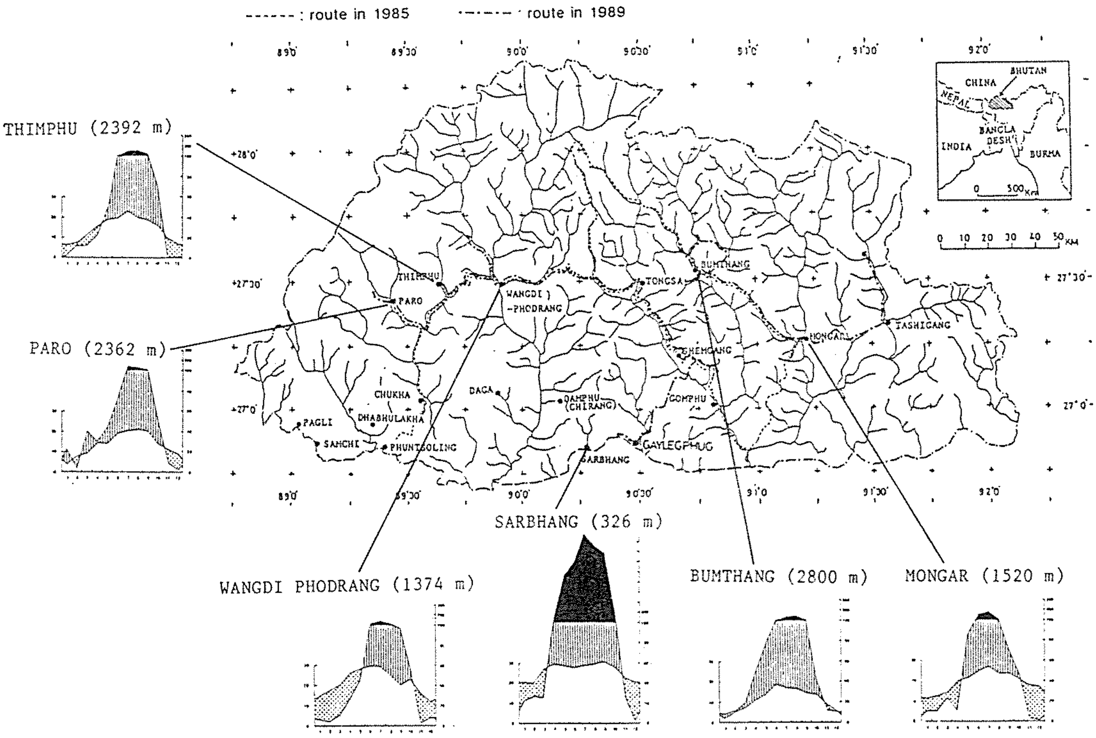

Fig. 1. Map showing the studied area and route in 1985 and 1989 and Walter's climate diagram at six locations.

1989 Expedition

In 1989, the second field survey was carried out supported again by Monbusho to make an intensive study on the subtropical and warm-temperate life zones. We selected these regions as the first site for intensive study because the two zones are the most vulnerable ecosystem due to its close proximity to the human habitation.

We have made intensive study in the following five places, i.e. east slope of Dochu la, around Wangdi Phodrang, west slope of Pele la, Dak pai and Buri, Gaylegphug, north of Bumthang, Lingmethang and Rindergang, Tashigang, and Tashi Yantshi (see the map).

Climatic variation

Bhutan and its surrounding areas experienced very heavy rainfall in May and June 1989. According to Mr. T. Eguchi, the University of Tokyo, a climatologist of our team, it rained more than 100 mm a day on 27 and 28 June 1989 and also more than 50 mm a day from 13 to 16 June 1989. These very heavy rainfalls caused landslides in many places. When we arrived in Thimphu on 3 October 1989, we were informed that the roads were still blocked at several places by landslides and we realized that it was true. However, most of the places were already cleared by road workers.

The climatic conditions on a shorter time scale than month were studied and such climatic features as the seasonal march, the regional difference, the duration of no-precipitation, and the cause of the precipitation on a synoptic scale using the daily rainfall data will be clarified.

Midland dry valley, its pattern and cause

The occurrence and causes of midland dry valley in the Himalaya has been studied by many

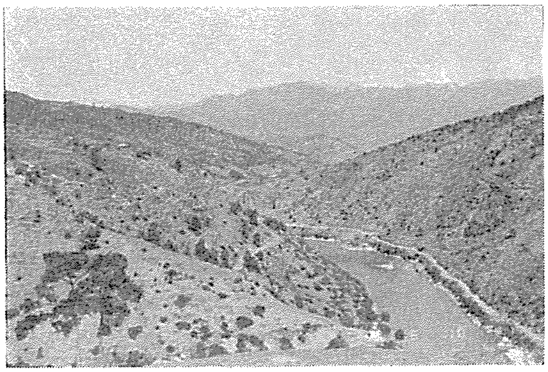

Fig. 2. The landscape of dry valley near Wangdi Phodrang, along Sankosh River. At about alt. 1,300 m.

scientists since the first notice by Schweinfurth (1956). Both climatic and human factors are related to the formation of the dry valley, therefore it is an ecological phenomenon.

To elucidate climatic factors of the dry valley, the observation of local wind was carried out in midland dry valley along the Sankosh River, near Wangdi Phodrang. The analytical results of daily rainfall are also expected to be useful to show the precise climatic condition and the cause of the dry valley. On the east-facing slope of the Sankosh River, five automated thermometers were settled at different altitude from 1,400 m to 3,000 m in order to clarify the altitudinal change of the thermal conditions of dry valley. The soil moisture measurements using soil tensiometer were also conducted in November 1989. Vegetation surveys on the same slope were carried out and it seemed to be heavily affected by grazing of domestic animals. Local people are using even *Opuntia* as a fodder for pigs.

Topography and its dynamics

In the Bhutan Himalaya metamorphic rocks are extensively distributed as the same as in other parts of the Himalaya. Asymmetric ridges (or valleys) and prevalences of specific slope direction are often observed in the area underlain by these rocks. The strikes and dips of schistosity foliation planes and mountain slopes were measured along the route by Mr. M. Takada, the University of Tokyo. The results seem to suggest that in many cases the gentle slope of an asymmetric ridge (or valley) and the prevalence of specific slope direction are influenced by schistosity foliation planes. Many landslide and rockslide masses were observed in such area. The evidence of past rockslide formed along a schistosity foliation plane was found close to Shemgang, South Bhutan. From these it may be inferred that such mass movement, which occurs along a schistosity foliation plane, makes a lot of mountain slopes.

Vegetation distribution and regeneration

Forests of the subtropical (1,000–2,000 m) and warm-temperate (2,000–2,500 m) zones are the most important wealth of the Bhutanese vegetation. Probably this is the last piece of the warm-temperate rain forest in the Himalaya or even in the world. I studied forests in its distribution, species composition, structure, and regeneration processes together with Dr. M. Hara, Natural History Museum and Institute, Chiba. The principal factors that cause the differentiation of forest types in this region are the local climatic factors and topography as well as human disturbances. The xeric type vegetation developed in the dry valley in middle reaches of the main river system, which flow down from north to south, is the largest scale phenomena of intrazonal and/or azonal differentiation of vegetation.

The habitat gradients in a small valley cause the middle scale differentiation of forests from the humid ravines to xeric south-facing slopes. At some of the vegetational survey sites, geomorphological cross sections were measured, soil profiles were observed and samples of soil materials were obtained. At this scale the forest shows clear contrast between north- and

Fig. 3. Mosaic patches of various stages of secondary forests regenerated after shifting cultivation. Surrounding forests with irregular canopy surface are the intact forests. Near Thaley, alt. 1,790 m.

Fig. 4. *Castanopsis tribuloides* has just been felled to produce fire woods. The woods were collected from a pollarding tree, a part of bolling can be seen at right margin. Near Thaley, alt. 1,790 m.

south-facing slopes. Analyses of the collected data and samples clarify origins of landform, present soil moisture states and degree of slope stability as well as vegetation distribution along topographical gradients.

The results will provide important information on environmental conditions influencing vegetational stability and dynamics. And the information can be compiled to make 'topo-successional matrix,' which is useful for scientific management of mountain ecosystem. It must be needed also for the restoration of degraded mountain ecosystem.

The regeneration processes of the evergreen broad-leaved forests were also studied. Shifting cultivation is the common practice in this region. Mosaic patches of various stages of forest regeneration after fallow could be observed on a slope. After the repeated practice of shifting cultivation, the depauperation of floristic diversity was evident. After repeated coppicing the forest is almost purely dominated by vegetatively regenerated (by sprouts) species such as *Castanopsis tribuloides* with some shrubby species which invaded into fallow fields such as *Edgeworthia*, *Indigofera*, *Viburnum* and *Eurya*.

We have also made vegetation study about grasslands and weeds. Grassland vegetation is extensive in middle to high altitudinal zones. The types, distribution and succession of the grassland vegetation were studied by Profs. M. Numata and K. Tsuchida, Shinshu University. Rotation between grasslands and cultivated fields such as buckwheat, wheat and barley was commonly observed in Central Bhutan. The dwarf bamboo, *Arundinalia*, which often grows 3 to 5 m tall as the undergrowth of *Tsuga dumosa* and *Abies densa* forests, becomes a short mat in grazing grasslands in Central Bhutan. This might be a homologous vegetation between Bhutan and Mt. Aso, Kyushu, Japan.

Conclusion

The ecological information of intact or less disturbed nature of the Bhutan Himalaya is useful for the restoration ecology of the degraded mountain ecosystems in some other comparable places such as eastern Nepal and also for preventing further degradation of the mountain ecosystem in Bhutan. It is also the prime requisite for the people of mountainous areas to maintain their sustainable life.

(Chiba University)

Ecological Studies on Non-reefal Coral Communities in the Gulf of Thailand

Moritaka Nishihira

Non-reefal coral communities are distributed among the Sichang Islands in the inner part of the Gulf of Thailand. The most striking features of the coral communities in this area are 1) the overwhelming dominance of massive *Porites*, 2) the great abundance of *Diadema*, 3) abundant populations of boring organisms, and 4) an abundant population of spatangoid urchins, together with a high density of free-living corals.

Based on the first field surveys in 1984, we conducted the second survey at Khang Khao Island and Sichang Island (Fig. 1) in November-December 1987. Research facilities were arranged and/or provided by Sichang Marine Research and Training Station of Chulalongkorn University. This project was conducted by cooperative research team of University of the Ryukyus and Chulalongkorn University as one of the Japanese MAB research program, and was financially supported by the Japanese Ministry of Education, Science and Culture (Nishihira & Sudara, 1989).

Some of our findings have been published in a series of 9 papers in Galaxea, volume 8, 179–310 pp.

Sakai *et al.* (1989) studied coral communities on the hard substrate. The coral communities were dominated by the massive *Porites* in many places, and plate-like coral *Montipora* was dominant in some places, showing low species diversity (H'c) and evenness (J'c). Competitive ability cannot explain the great dominance of *Porites*, which is not a superior competitor. The percent cover of each species summed up over entire studied area showed a significant correlation with the number of interactions in which that species was involved, suggesting a space-dependent interaction. *Porites* showed more clumped dispersion in the place where *Montipora* had the highest cover, which suggests the competitive suppression of *Porites* by *Montipora*, and importance of competition in community structuring. Great abundance of boring organisms and intensive grazing by *Diadema* seem also important in community structuring process.

Kamura (1989) conducted caging experiments for 3 weeks to test impact of grazing by the sea urchin *Diadema* on algal communities. Algal biomass and species numbers gradually increased on nearly barren, dead coral substrates in closed cages excluding urchins. But the siphonous green algae occurred within the grazed as well as ungrazed areas throughout the study period. Such species may occur in the earlier phase of algal succession on natural, dead coral substrates subjected to intense grazing. The species composition on ungrazed substrates was close to

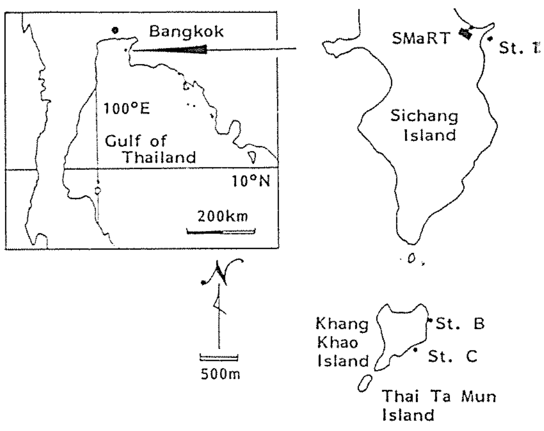

Fig. 1. Map showing the location of the Sichang Islands and the major study site, Khang Khao Island. The field studies in 1987 were conducted at Sts. 1, B and C.

that of algal lawns within damselfish territories.

Choonhabandit & Tsuchiya (1989) studied the distribution of shallow subtidal macrobenthos on the sandy bottom. The spatangoid *Brissus* was abundant and created remarkable bottom surface irregularities, mounds and funnels. Another spatangoid, *Lovenia*, was common on the finer sediment. The echinoid *Diadema* and oysters, mainly *Dendrostrea*, were found in shallow water, while an unidentified sea pen and barnacles lived in deeper place. The sea urchin *Salmacis* showed a similar distribution pattern to that of *Brissus*.

Tsuchiya *et al.* (1989a) studied sediment reworking activity of *Brissus*. Larger urchins reworked sediment at a faster rate. The sediment reworking activity creates and maintains the heterogeneity of the sandy bottom, since they make mounds consisting of small particles and funnels with a high proportion of large particles. These two microhabitats harbored different communities of small infauna. The lancelet *Brachiostoma* occurred more abundantly in the mounds. There were patches of the mussel *Modiolus* which supported another characteristic community dominated by polycheates, gastropods and shrimps.

Tsuchiya *et al.* (1989b) studied coral-associated animals of *Pocillopora damicornis*. The xanthid crab *Trapezia cymodoce* was found only in large colonies as a heterosexual pair, and crab size was positively correlated with coral colony size. *Alpheus lottini* occurred in the 2 largest colonies, each time as a heterosexual pair. A scarcity of such obligately symbiotic species seems to be characteristic. The species diversity (H'), species richness, and number of individuals all increased with colony size, while the numbers of species and individuals per unit interbranch space decreased with colony size.

Nishihira & Poung-In (1989) studied population of fungiid coral *Diaseris fragilis*. It had a maximum density of 18.5/m^2. In the high density area, the corals showed a clumped dispersion. Yamashiro *et al.* (1989) studied autotomy of *Diaseris fragilis*. The alizarin-method and SEM observations suggest that skeletal growth stops or at least slows down at several points along the growing edge of the skeleton. The continued growth of the rest of the edge, rather than active dissolution of the skeleton, results in the formation of the slits.

Kurozumi *et al.* (1989) made a check list of 198 species of marine molluscs collected in the Sichang Islands.

Our ultimate goal is to explain why, in the Sichang Islands and similar situations, only non-reefal coral communities are developed, or in other words, why structural reefs are not formed. Such non-reefal coral assemblages occur widely in warm temperate seas as well as in turbid bay waters in tropical seas; therefore, the answer to this question is important for a general understanding of coral communities.

Perhaps the activities of the destructive agents outpace those of the constructive agents. The great activity of grazers and borers may explain, at least in part, the failure to form structural

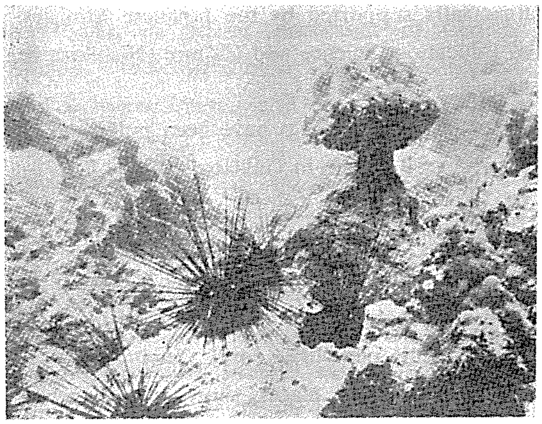

Fig. 2. Photograph showing the general scene in the peripheral area of the coral zone. At the center, a colony of massive *Porites* has become mushroom-shaped, due to heavy grazing by *Diadema*. At the middle right, several burrow openings of a boring bivalve, *Lithophaga*, are seen.

reefs. Fig. 2 illustrates the effects of both kinds of activity. However, this cannot explain the great dominance of massive *Porites* in the coral communities.

In the future we must test this assumption about the importance of borers and grazers, and analyze intra- as well as inter-specific interactions in the present communities. The great abundance of destructive agents must be explained, their effect on reef formation investigated, and the great abundance of *Porites* accounted for.

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(University of the Ryukyus)

Announcement

Unesco/MAB International Seminar "Future Research Trends in MAB" (FRTM)

Unesco/MAB International Seminar "Future Research trends in MAB" (FRTM) is to be held on 20–22 August 1990 at the Tokyo University of Fisheries, Tokyo, Japan. There will be three scientific sessions:

Session 1: Rehabilitation of Coastal Fishery Areas and of Other Ecosystems

Session 2: Development of Methods for Improving the Estimates of Ecosystem Dynamics towards Sustainable Ecosystem Management

Session 3: Contribution of "Man and the Biosphere" Programme to Grobal Changes Studies

A full day excursion by bus to Tsukuba Scientific City visiting National Institute for Environmental Studies, Institute for Forest Research, Lake Kasumigaura, etc. is scheduled.

Those who wish to participate in the seminar should contact the organizing committee at the following address.

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